1.2 Antibiotics dispensing in children, 9 years and under

**Why is this important?**

Much of current antibiotic use is inappropriate, with antibiotics being prescribed for viral illnesses when their use is not indicated.\(^1\) More than 30 million prescriptions for antimicrobials were dispensed to people of all ages in the Australian community in 2015, with no change in this number since 2008.\(^2\) There are harms associated with high use of antibiotics. For example, development of bacterial resistance that means some antibiotics are no longer effective in combating infections. Antimicrobial resistance is known to be increasing in Australia.\(^2\) Other potential harms of high use of antibiotics are now being investigated. Antibiotic use in children is associated with a higher risk of asthma, Crohn's disease and weight gain, although researchers are still exploring these links.\(^3\)\(^-\)\(^6\)

**What did we find?**

The rate of dispensing of antibiotics to children aged 9 years and under is almost equivalent to one antibiotic prescription annually per child in this age group in Australia.

**What can be done?**

Improving antibiotic prescribing has been a focus of attention for many years, but there has been limited success in reducing rates.\(^7\)\(^-\)\(^10\) Sustained and concerted efforts to ensure patient and community awareness of the potential harms associated with antibiotic use in children are essential.\(^2\)\(^,\)\(^11\) Improving patient knowledge of the trade-offs between likely benefits and harms has been shown to reduce the use of antibiotics.\(^12\)\(^,\)\(^13\) Tools to assist with shared decision making should be promoted to ensure that parents are properly informed about appropriate use of antibiotics in their children. More attention needs to be given to strategies that would encourage clinician adherence to guidelines on appropriate prescribing.\(^11\)
Antibiotics dispensing in children, 9 years and under

Context
This item focuses on rates of antibiotic dispensing for children aged 9 years and under. Antibiotics are used to treat infections, and to prevent infections in some susceptible patients (for example, during some types of surgery). Antibiotic use in Australia is highest in children aged 0–9 years and in older people (aged 65 years and over). Upper respiratory tract infections are a common reason for seeking medical care, accounting for 26% of paediatric general practitioner (GP) consultations in Australia. As most respiratory tract infections are caused by viruses, antibiotics have a limited role in treatment and should be reserved for cases in which a bacterial cause is suspected. Inappropriate use of antibiotics was highlighted by a 2017 Australian study showing that GPs prescribed antibiotics for acute respiratory infections in children and adults at 4–9 times the rate expected if guidelines were followed. Australia’s rate of antibiotic use for children aged 9 years and under is about three times higher than that of similar countries such as Norway and the Netherlands.

Antibiotic use promotes bacterial resistance, both in the individual and the community. For example, an individual prescribed an antibiotic for a respiratory tract infection is more likely to carry bacteria resistant to that antibiotic within 12 months of use. Longer duration of antibiotic use and multiple courses are associated with higher rates of bacterial resistance in an individual. Children appear to be important transmitters and recipients of resistant bacteria, so inappropriate antibiotic use in children affects rates of resistance in the whole community.

Evidence of a link between childhood antibiotic use and an increased risk of chronic diseases is growing, but is based on observational data. Antibiotic use causes changes in the gut microbiome, and this may cause immune system changes that subsequently increase the risk of some conditions. Antibiotic use in young children and babies is associated with an increased risk of asthma. Childhood use of certain antibiotics is associated with an increased risk of weight gain, and the risk is higher with more courses of antibiotics. Childhood antibiotic use is also associated with an increased risk of developing Crohn’s disease. The incidence of inflammatory bowel disease in children has increased markedly in Australia and worldwide, and antibiotic use has been suggested as a contributor to this trend.

About the data
Data are sourced from the Pharmaceutical Benefits Scheme (PBS) dataset. This dataset includes all prescriptions dispensed under the PBS or the Repatriation Pharmaceutical Benefits Scheme, including prescriptions that do not receive an Australian Government subsidy. Note that some dispensed medicines may not be used.

The dataset does not include prescriptions dispensed for patients during their admission to public hospitals, discharge prescriptions dispensed from public hospitals in New South Wales and the Australian Capital Territory, direct supply of medicines to remote Aboriginal health services, over-the-counter purchase of medicines, doctor’s bag medicines or private prescriptions.

Rates are based on the number of prescriptions dispensed for systemic antibiotics per 100,000 children aged 0–9 years in 2016–17. Antibiotics used orally, intravenously and intramuscularly are included; topical antibiotics are not included.

The term ‘antibiotics’ is used rather than ‘antimicrobials’ in this data item because other antimicrobials (antifungals, antivirals and antiparasitics) are not included. Note that the repeat analysis of antimicrobial medicines (in Chapter 5, page 239) includes a wider range of antimicrobials, not only antibiotics.

The analysis and maps are based on the residential address of the patient recorded in the PBS prescription claim and not the location of the prescriber or the dispensing pharmacy.
Rates are age and sex standardised to allow comparisons between populations with different age and sex structures.

This analysis was not undertaken by Aboriginal and Torres Strait Islander status because this information was not available for the PBS data at the time of publication.

**What do the data show?**

**Magnitude of variation**

In 2016–17, there were 3,053,315 PBS prescriptions dispensed for antibiotics in children, representing 96,721 prescriptions per 100,000 children aged 9 years and under (the Australian rate).

The number of PBS prescriptions dispensed for antibiotics across 328* local areas (Statistical Area Level 3 – SA3), ranged from 9,707 to 159,688 per 100,000 children aged 9 years and under. The rate was 16.5 times as high in the area with the highest rate compared to the area with the lowest rate. The number of prescriptions dispensed varied across states and territories, from 69,015 per 100,000 children aged 9 years and under in the Northern Territory to 102,339 in Queensland (Figures 1.4–1.7).

After the highest and lowest 10% of results were excluded and 264 SA3s remained, the number of prescriptions dispensed per 100,000 children aged 9 years and under was 1.7 times as high in the area with the highest rate compared to the area with the lowest rate.

**Analysis by remoteness and socioeconomic status**

Rates of antibiotic dispensing in children aged 9 years and under were higher in major cities than in other areas. Rates were higher in areas with lower socioeconomic status in major cities and inner regional areas. However, there was no clear pattern according to socioeconomic status in other remoteness categories.

Low rates of antibiotic dispensing in some remote, low-socioeconomic-status areas may be underestimates because dispensing through Aboriginal health services is not captured in the data (Figure 1.8).

* There are 340 SA3s. For this item, data were suppressed for 12 SA3s due to a small number of prescriptions dispensed and/or population in an area.
Antibiotics dispensing in children, 9 years and under

Analysis by age group

The rate of antibiotic dispensing was higher for children aged 4 years and under (113,906 prescriptions per 100,000 children) than for children aged 5–9 years (80,417 prescriptions per 100,000 children). This pattern was consistent across all states and territories (Figure 1.2).

Figure 1.2: Number of PBS prescriptions dispensed for antibiotics per 100,000 children in specific age group, sex standardised, by state and territory of patient residence, 2016–17

Children dispensed at least one prescription

The number of children aged 9 years and under who had at least one prescription for an antibiotic dispensed in 2016–17 was 45,085 per 100,000 – that is, 45% of the child population aged 9 years and under. The rate varied from 32,108 per 100,000 children aged 9 years and under in the Northern Territory to 46,824 per 100,000 in New South Wales (Figure 1.3).

Figure 1.3: Number of children dispensed at least one antibiotic per 100,000 children aged 9 years and under, age and sex standardised, by state and territory of patient residence, 2016–17

Notes:
For further detail about the methods used, please refer to the Technical Supplement.
**Interpretation**

The overall rates of antibiotic dispensing in children aged 9 years and under are high. Variation in rates of antibiotic dispensing is likely to be due to geographical differences in the factors discussed below.

**Clinical decision-making**

Differences in clinicians’ perceptions, attitudes towards managing patient illness and patient expectations, and prescribing behaviour will affect patterns of antibiotic prescribing. Clinician adherence to guidelines about antibiotic use (for example, prescribing antibiotics for upper respiratory tract infections only when a bacterial infection is identified) is likely to affect rates of dispensing. Clinician non-adherence to guidelines, such as prescribing antibiotics for viral infections, will contribute to higher rates of inappropriate antibiotic use.

**Socioeconomic status and health literacy**

Parents with lower levels of education may have a poorer understanding of viral versus bacterial causes of childhood illnesses, and may have a greater expectation of antibiotic prescription for viral illnesses. Other groups with low health literacy may also have higher expectations of antibiotic prescription, which in turn influences GP prescribing behaviour. In some cases, prescribers may incorrectly assume that patients expect a prescription for an antibiotic.

**Rates of underlying illnesses**

The local rate of bacterial infections that require antibiotic treatment is likely to affect rates of dispensing. Rates in some areas may be increased by small numbers of patients who require frequent antibiotics – for example, children with chronic diseases such as cystic fibrosis. Variation could also be influenced by local rates of influenza (flu) vaccination, as this could affect the number of patients seeking antibiotics during the flu season.

The burden of infectious disease tends to be higher in low-income communities. The rate of infections may be influenced by social and housing conditions, including smoking in the household and overcrowding, and other factors such as climate. Low rates of antibiotic dispensing in some remote, socioeconomically disadvantaged areas may be underestimates because dispensing through Aboriginal medical services is not captured in the data.

**Access to medical care**

Geographic access to medical care and the ability to pay out of pocket costs, are likely to affect the rates of people seeking care from clinicians for conditions that may require antibiotic treatment, or that are believed to require treatment, and subsequent rates of antibiotic dispensing. Clinicians treating patients who face financial or geographical barriers to accessing care may be more likely to prescribe opportunistically because of uncertain follow-up of the patient. Additionally, clinicians in regional and remote Australia may have less access to pathology services to support their decision-making.

**Data limitations**

Rates in remote geographic areas with high proportions of Aboriginal and Torres Strait Islander children are likely to be artificially low because the PBS dataset does not include data from Aboriginal health services, which supply medicines under the S100 scheme (an alternative arrangement for supplying PBS medicines).

Rates of prescriptions dispensed could be different from rates of medicines consumed.
Antibiotics dispensing in children, 9 years and under

Promoting appropriate care

Increasing antibiotic resistance highlights the urgency of reducing Australia’s rate of inappropriate antibiotic use in children, especially in the areas shown to have the highest rates. Although the link between childhood antibiotic use and diseases in later life is not firmly established, this possibility adds to the case for restricting antibiotic use to situations where the need for antibiotics is clear.

Many groups have been working to reduce inappropriate antibiotic use in Australia; some success has been seen, but major challenges remain. Antimicrobial use in Australian hospitals has been declining since the peak usage rate in 2010. However, most antibiotic use occurs in the community. The rate of antimicrobial prescribing in the community in Australia peaked in 2008, and the rate in 2015 was very similar, with more than 30 million prescriptions for antimicrobials in Australia in 2015. Sustained efforts, combining different approaches, will be needed to make a difference to community prescribing.

A lack of access to data on dispensing from Aboriginal health services limited the current analysis, and initiatives to include these data are vital to providing a more complete picture of antibiotic use across Australia. Differences in the burden of disease need to be taken into account when interpreting antibiotic use in different settings. Interventions to address antibiotic resistance need to take into account differences in the type of infections in Aboriginal and Torres Strait Islander children in some areas compared with other children, as well as cultural differences.

In an Australian survey of GPs, patient expectations were the main reason given for prescribing antibiotics for an upper respiratory tract infection. This overarching reason may include other factors such as limited time, poor doctor–patient communication and diagnostic uncertainty.

Communication skills training for prescribers and shared decision making have been successful in reducing antibiotic use for respiratory tract infections in the community. Communication skills training evaluated in trials involved learning to deal with perceived pressure to prescribe, and to communicate with patients about their expectations on antibiotic prescribing. This training reduced the rate of antibiotic prescribing for lower respiratory tract infections from 54% to 27% among patients in a Dutch trial. A multi-centre European trial reported a reduction in primary care antibiotic prescribing for upper respiratory tract infections from 45% to 36% with internet-based communication skills training.

Shared decision making has been shown to reduce the rate of antibiotic prescribing for acute respiratory infections in general practice from 47% to 29%. In shared decision making interventions, the patient and clinician discuss the benefits and harms of antibiotic treatment, and the evidence of antibiotic effectiveness. Patient decision aids on antimicrobial use, including for sore throat, acute bronchitis and middle ear infection in children, have been developed for use in the Australian primary care setting. Interventions that promote shared decision making could also provide clinicians with skills that can be used in the management of other conditions, which may add to the cost-effectiveness of this approach.

Counselling about appropriate use of antibiotics can be more time-consuming than writing a prescription, and time pressures on doctors are a contributor to inappropriate antibiotic prescribing. Using resources to aid explanations of why an antibiotic prescription is not appropriate for some conditions, and support from nurse practitioners in counselling patients about antibiotic use, could help reduce inappropriate prescribing.
Public education is essential for supporting any interventions targeting prescribers, and ongoing, repeated efforts are required to make a substantial change in public awareness of the issues concerning antibiotic prescribing. NPS MedicineWise has led programs to reduce the inappropriate use of antibiotics in Australia, including academic detailing and prescribing feedback for GPs, as well as public awareness campaigns. Some success has been seen; for example, NPS MedicineWise campaigns between 2009 and 2015 were estimated to have resulted in a reduction of 14% in antibiotic dispensing volumes over this period. However, data showing that GPs prescribe antibiotics at 4–9 times the rate expected if guidelines were followed highlight the size of the challenge that remains.

A variety of other interventions could help reduce overuse of antibiotics in Australia – for example, changes to prescribing software so the default option for antibiotic prescriptions is ‘no repeats’, and aligning the dispensed amount of antibiotic with the recommended duration of therapy to avoid leftover doses. Providing antibiotic prescriptions to patients with respiratory tract infections for use if symptoms do not resolve (delayed prescriptions) is another strategy that reduces unnecessary use of antibiotics.
Antibiotics dispensing in children, 9 years and under
Rates by local area

Figure 1.4: Number of PBS prescriptions dispensed for antibiotics per 100,000 children aged 9 years and under, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17

Notes:
For further detail about the methods used, please refer to the Technical Supplement.

Antibiotics dispensing in children, 9 years and under

Rates across Australia

Figure 1.5: Number of PBS prescriptions dispensed for antibiotics per 100,000 children aged 9 years and under, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17

Notes:
For further detail about the methods used, please refer to the Technical Supplement.
Rates across capital city areas

Figure 1.6: Number of PBS prescriptions dispensed for antibiotics per 100,000 children aged 9 years and under, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17

Notes:
For further detail about the methods used, please refer to the Technical Supplement.
Antibiotics dispensing in children, 9 years and under
Rates by state and territory

Figure 1.7: Number of PBS prescriptions dispensed for antibiotics per 100,000 children aged 9 years and under, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17

<table>
<thead>
<tr>
<th>Highest rate</th>
<th>NSW</th>
<th>Vic</th>
<th>Qld</th>
<th>WA</th>
<th>SA</th>
<th>Tas</th>
<th>ACT</th>
<th>NT</th>
</tr>
</thead>
<tbody>
<tr>
<td>101,950</td>
<td>159,688</td>
<td>136,694</td>
<td>142,207</td>
<td>121,012</td>
<td>115,504</td>
<td>101,857</td>
<td>109,733</td>
<td>119,885</td>
</tr>
<tr>
<td>Lowest rate</td>
<td>66,391</td>
<td>57,562</td>
<td>48,065</td>
<td>35,930</td>
<td>58,958</td>
<td>48,730</td>
<td>82,273</td>
<td>9,707</td>
</tr>
<tr>
<td>No. prescriptions</td>
<td>1,023,567</td>
<td>738,699</td>
<td>664,062</td>
<td>302,588</td>
<td>196,083</td>
<td>44,699</td>
<td>52,890</td>
<td>26,240</td>
</tr>
</tbody>
</table>

Each circle represents a single SA3. The size indicates the number of prescriptions dispensed.

Notes:
For further detail about the methods used, please refer to the Technical Supplement.

Rates by remoteness and socioeconomic status

Figure 1.8: Number of PBS prescriptions dispensed for antibiotics per 100,000 children aged 9 years and under, age and sex standardised, by Statistical Area Level 3 (SA3) of patient residence, 2016–17

Notes:
For further detail about the methods used, please refer to the Technical Supplement.

Antibiotics dispensing in children, 9 years and under

Resources

- Therapeutic Guidelines: Antibiotic48, including mobile app
- Australian Commission on Safety and Quality in Health Care, Antimicrobial Stewardship Clinical Care Standard49
- Australian Commission on Safety and Quality in Health Care, patient decision aids on antibiotic use for sore throat, acute bronchitis and middle ear infection50–52
- Australian Commission on Safety and Quality in Health Care, Helping Patients Make Informed Decisions: Communicating risks and benefits (eLearning module)50
- NPS MedicineWise, What Every Parent Should Know About Colds, Coughs, Earaches and Sore Throats
- NPS MedicineWise, antimicrobial learning modules
- Australian Government, Nurses and antimicrobial resistance fact sheet
- Australian Government, What health professionals can do; What you can do (infographics)

Australian initiatives

The information in this chapter will complement work already under way to improve the appropriateness of antibiotic use in children in Australia. At a national level, this work includes:

- Antimicrobial Stewardship Clinical Care Standard and accompanying indicators49
- Antibiotic Awareness Week
- Antimicrobial Use and Resistance in Australia (AURA) Surveillance System2
- Australia’s First National Antimicrobial Resistance Strategy 2015–201910
- National Antimicrobial Prescribing Survey, education and training10
- National Antimicrobial Utilisation Surveillance Program52
- NPS MedicineWise consumer and clinician interventions
- Royal Australian College of Physicians Paediatrics Child Health Division, Choosing Wisely recommendation 1: Do not routinely prescribe oral antibiotics to children with fever without an identified bacterial infection53
- Royal Australian College of General Practitioners, Choosing Wisely recommendation 9: Don’t treat otitis media (middle ear infection) with antibiotics, in non-Indigenous children aged 2–12 years, where reassessment is a reasonable option9
- Australian Society of Infectious Diseases, Choosing Wisely recommendations 1–4:
  - Do not use antibiotics for asymptomatic bacteriuria
  - Do not take a swab or use antibiotics for the management of a leg ulcer without clinical infection
  - Avoid prescribing antibiotics for upper respiratory tract infection
  - Do not investigate or treat for faecal pathogens in the absence of diarrhoea or other gastrointestinal symptoms.54
Many state and territory initiatives are also in place to improve the appropriateness of antibiotic use in children, including antimicrobial stewardship programs and guidelines for managing childhood infections. For example:

- The Tasmanian Infection Prevention and Control Unit provides feedback to rural inpatient facilities and GP prescribers on their antimicrobial prescribing, and Primary Health Tasmania provides education on antimicrobial prescribing.

- Safer Care Victoria, New South Wales Health and Queensland Health have recently developed the Paediatric Improvement Collaborative; this involves a tri-state memorandum of understanding and funding agreement to enable New South Wales Health and Queensland Health to formally use the Victorian clinical practice guidelines.
Antibiotics dispensing in children, 9 years and under

References


